

REMARKS

Applicants respectfully request reconsideration of the application, as amended, in view of the following remarks.

The present invention as set forth in **amended Claim 1** relates to a **chiral nematic liquid crystal optical element**, comprising:

a pair of substrates with transparent electrodes; and
a liquid crystal layer having a memory property interposed between the substrates;
a first resin layer which is provided on at least one of the transparent electrodes,
said first resin layer having a rubbed vertical alignment surface in contact with the liquid crystal layer;

wherein said liquid crystal layer exhibits a planar state and a focal conic state.

Claims 2-4 and 11-18 depend on Claim 1.

The importance of the rubbed vertical alignment surface of the first alignment layer is discussed at page 22 to page 24, line 22:

“In accordance with the present invention, the alignment layer of at least one of the substrates is a vertical alignment layer subjected to rubbing (hereinbelow, also referred to as RVA: Rubbed Vertical Alignment).

As a result, some of helical axes of the domains in a region of the liquid crystal in contact with the RVA are aligned by surface interaction, for example anchoring strength. Thus, coupling occurs between planar domains. There is a clear tendency for planar domains to be formed at a greater size than normal. As a result, the liquid crystal layer exhibits reflection characteristics as if the liquid crystal layer is a mirror. Thus, it becomes possible to perform display with light having high brightness.

On the other hand, when an interface obtainable by subjecting a horizontal alignment layer to a rubbing treatment is provided on one of the inner planes of the liquid crystal cell, the following situations are provided. When the liquid crystal layer is in PL, the liquid crystal layer performs display in high brightness as in the case stated earlier. When the liquid crystal layer is in FC, the alignment tends to partly returns to planar alignment. In the latter case, selective reflection by PL overlaps with scatter by FC. As a result, the contrast ratio reduces to about 50-60% in comparison with the contrast ratio in normal display with two states of PL and FC utilized therein.”

(PL-planar, FC-focal conic)

None of the cited references disclose or suggest, alone or in combination, a chiral nematic liquid crystal optical element as claimed having a **first resin layer having a rubbed vertical alignment surface in contact with the liquid crystal layer which exhibits a planar state and a focal conic state.**

Tanaka et al disclose twisted nematic (TN) and super twisted nematic (STN) liquid crystal displays (LCDs) (Tanaka et al, Summary of the Invention). Alignment films made of polyimide are used (Tanaka et al, layers 2A and 2B in Figures 1 and 2 and col. 10, lines 20-29). However, there is no disclosure or suggestion of a vertical alignment layer. Tanaka et al use a slightly tilted horizontal alignment layer having a pre-tilt angle of about 1-5° (Tanaka et al, col. 11, line 39-40) and not vertical alignment layers.

In addition, the liquid crystal in Tanaka et al does **not** exhibit **a planar state and a focal conic state**. Thus, Claims 1, 2, 9 and 13 are not anticipated by or obvious over Tanaka et al.

Lee et al fails to cure the defects of Tanaka et al. In contrast to the claimed invention, Lee et al disclose only an electrically controlled birefringence (ECB)-in plane switching (IPS) mode liquid crystal display (Lee et al, col. 1, lines 4-10). Lee et al fail to disclose or suggest a chiral nematic liquid crystal optical element in which the liquid crystal layer exhibits a planar state and a focal conic state, as claimed.

Another feature of the optical display element of Lee et al is that the **counter electrodes are located on the same substrate** (Lee et al, Figures 1A and B, col. 2, lines 38-40). However, in the display of the present invention each substrate has a transparent electrode. Thus, even if Tanaka et al and Lee et al were combined, one cannot arrive at the claimed display.

West et al also fail to cure the defects of Tanaka et al and Lee et al.

West et al disclose multistable chiral nematic displays. However, the displays use either no alignment layer (West et al, Example 1) or unrubbed polyimide (West et al, col. 7, line 4, Example 2) or other materials (West et al, col. 7, lines 1-10). However, there is no disclosure or suggestion that vertical alignment is achieved. In addition, the reference discloses that best results have been obtained using rubbed ITO without any additional surface treatments (West et al, col. 7, lines 9 and 10). Thus, this reference teaches away from using a resin layer having a rubbed vertical alignment surface as claimed in Claim 1.

Thus, even if Tanaka et al, Lee et al and West et al were combined, one cannot arrive at the claimed display.

JP 08-220326 fails to cure the defects of Tanaka et al, Lee et al and West et al because there is no vertical alignment layer. In fact, all that this reference discloses is a color filter and not a liquid crystal display. Therefore, the combination with JP 08-220326 is not proper since this reference is not relevant for LCD's. However, even if combined with Tanaka et al, Lee et al and West et al, the claimed invention cannot result.

Therefore, the rejection of Claims 1, 2, 9 and 13 under 35 U.S.C. 103(a) over Tanaka et al in view of Lee et al, the rejection of Claims 3, 4 and 14-17 under 35 U.S.C. 103(a) over Tanaka et al in view of Lee et al and further in view of JP 08-220326 and the rejection of Claims 10-12 and 18 under 35 U.S.C. 103 (a) over Tanaka et al in view of Lee et al and further in view of West et al are believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of these rejections is respectfully requested.

Further, the rejection of Claims 5 and 6 under 35 U.S.C. § 102(b) over Mukoh et al in view of Nishiyama et al, the rejection of Claims 7, 8, 19 and 22 under 35 U.S.C. § 103(a) over Mukoh et al in view of Nishiyama et al and JP 08-220326, the rejection of Claims 23 and 24 under 35 U.S.C. 103 (a) over Mukoh et al in view of Nishiyama et al and further in view of West et al, the rejection of Claim 20 under 35 U.S.C. 103 (a) over Mukoh et al in

view of Nishiyama et al, and JP 08-220326 and further in view of Tanaka et al, the rejection of Claim 21 under 35 U.S.C. 103 (a) over Mukoh et al in view of Nishiyama et al and JP 08-220326 and further in view of Kumar et al are respectfully traversed.

The present invention as set forth in **amended Claim 5** relates to a **chiral nematic liquid crystal optical element**, comprising:

a pair of substrates with transparent electrodes; and
a liquid crystal layer having a memory property interposed between the substrates;
a **metal-oxide layer provided on at least one of the transparent electrodes**;
a first resin layer which is provided on at least one of the transparent electrodes,
said first resin layer having a rubbed vertical alignment surface in contact with the liquid crystal layer;
wherein said liquid crystal layer exhibits a planar state and a focal conic state.

Claims 6-8 and 19-23 depend on Claim 5.

None of the cited references disclose or suggest, alone or in combination, a chiral nematic liquid crystal optical element as claimed having a **metal-oxide layer provided on at least one of the transparent electrodes; a first resin layer having a rubbed vertical alignment surface in contact with the liquid crystal layer which exhibits a planar state and a focal conic state.**

Even though Mukoh et al disclose homeotropic alignment, the alignment layer is not a resin layer as claimed but a **surfactant layer** (col. 5, lines 34-48, embodiment 1 at col. 10, lines 48-53). In addition, the surfactant layers are **not rubbed** as currently claimed. In addition, the liquid crystal undergoes a **focal conic to homeotropic phase transition** and does not exhibit a focal conic and a planar state as claimed.

Nishiyama et al and JP 08-220326 do not cure the defects of Mukoh et al.

Nishiyama et al disclose **homeotropic** and hybrid type of liquid crystal devices and not a chiral nematic liquid crystal display in which the liquid crystal exhibits a planar and a focal conic state as claimed. Thus, even if Nishiyama et al is combined with Mukoh et al, the present invention cannot result.

JP 08-220326 fails to disclose or suggest a resin layer having a rubbed vertical vertical alignment surface. In fact, all that this reference discloses is a color filter and not a LCD. Therefore, the combination with JP 08-220326 is not proper since this reference is not relevant for LCD's. Thus, even if JP 08-220326 is combined with Mukoh et al and Nishiyama et al the claimed invention cannot result.

Tanaka et al disclose twisted nematic (TN) and super twisted nematic (STN) liquid crystal displays (LCDs) (Tanaka et al, Summary of the Invention). Alignment films made of polyimide are used (Tanaka et al, layers 2A and 2B in Figures 1 and 2 and col. 10, lines 20-29). However, there is no disclosure or suggestion of a vertical alignment layer. Tanaka et al use a slightly tilted horizontal alignment layer having a pre-tilt angle of about 1-5° (Tanaka et al, col. 11, line 39-40) and not vertical alignment layers.

In addition, the liquid crystal in Tanaka et al does not exhibit **a planar state and a focal conic state**. Thus, even a combination of Tanaka et al with Mukoh et al, Nishiyama et al and JP 08-220326 cannot result in the claimed invention.

Finally, Kumar et al are not particularly relevant as they fail to disclose or suggest a rubbed alignment layer. In fact, Kumar et al use UV treatment (see abstract) to form an alignment layer. Thus, even a combination of Kumar et al with Mukoh et al, Nishiyama et al, and JP 08-220326 and Tanaka et al cannot result in the claimed invention.

Therefore, the rejection of Claims 5 and 6 under 35 U.S.C. § 102(b) over Mukoh et al in view of Nishiyama et al, the rejection of Claims 7, 8, 19 and 22 under 35 U.S.C. § 103(a) over Mukoh et al in view of Nishiyama et al and JP 08-220326, the rejection of Claims 23

and 24 under 35 U.S.C. 103 (a) over Mukoh et al in view of Nishiyama et al and further in view of West et al, the rejection of Claim 20 under 35 U.S.C. 103 (a) over Mukoh et al in view of Nishiyama et al, and JP 08-220326 and further in view of Tanaka et al, the rejection of Claim 21 under 35 U.S.C. 103 (a) over Mukoh et al in view of Nishiyama et al and JP 08-220326 and further in view of Kumar et al are believed to be unsustainable as the present invention is neither anticipated nor obvious and withdrawal of these rejections is respectfully requested.

The objection to Claims 17 and 22 are obviated by the amendment of these claims.

The rejection of Claims 5, 7, 15 and 20 under 35 U.S.C. § 112, 2nd paragraph, is obviated by the amendment of these claims.

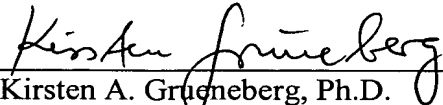
This application presents allowable subject matter, and the Examiner is kindly requested to pass it to issue. Should the Examiner have any questions regarding the claims or otherwise wish to discuss this case, he is kindly invited to contact Applicants' below-signed representative, who would be happy to provide any assistance deemed necessary in speeding this application to allowance.

Respectfully submitted,

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